Broad**Weigh**

User Manual

www.broadweigh.co.uk

BroadWeigh

Introduction / Overview **2**
Pack Contents 2
Quick Start **3**
Connecting Power 3
Handheld Display 3
BWSHK BroadWeigh Shackle 3
Opening the Case 3
Connecting Power 3
LED Indicator 3
Shackle Orientation & Identification 3
Basic Hand Held Operation **4**
Basic PC Logging Software **4**
BroadWeigh Resource CD 4
Main Window 4
Configure Workspace Window 6
T24-HR-BW Operation **8**
Keys 8
Indicators 8
Errors 8
Installation Considerations **9**
Overview 9
Interference 9
Antenna Orientation 10
Battery 10
T24 Toolkit **11**
Installation 11
Setup Base Station Communications 11
Home 12
Analyser 13
Data Provider Monitor 14
Advanced Users Only **15**
Common Configuration Pages for Both T24-HR and BWSHK 15
Channel and Encryption 15
Save and Restore 16
T24-HR Information 17
T24-HR Display Format 18
T24-HR Display Format Advanced Settings 19
BWSHK Information 20
BWSHK Battery and Radio Levels 21
BWSHK Battery and Radio Levels Advanced Settings 22
BWSHK Data Rates and Quality 23
BWSHK Calibration 25
BWSHK Calibration By Certificate 27
BWSHK Calibration Advanced 28
BWSHK Advanced Settings 30
Specifications **31**
General Radio 31
T24-HR 31
T24-SA 31
Approvals **33**
CE 33
FCC 33
Industry Canada 34
OEM / Reseller Marking and Documentation Requirements **34**
FCC 34
IC 34
CE 34
Declaration Of Conformity **36**
Worldwide Regional Approvals **37**
Important Note 37
Warranty **38**

Introduction / Overview

The BroadWeigh is a portable wireless weighing system offering real-time load monitoring for a wide variety of rigging applications without the need for time consuming and costly cabling.

Designed to aid riggers on a daily basis, the BroadWeigh enables users to know precise loads on any given point thereby ensuring structures and rigging points are balanced and within safe working loads.

A user-friendly wireless handheld provides load monitoring at your finger tips up to 200 metres of any shackle. In addition a PC interface can be used to view multiple inputs on a single screen via the use of the T24Log24 Software and USB base station.

The BroadWeigh Shackle (BWSHK) is a 4 ¾ Ton Crosby safety bow shackle with integrated electronics which features the following:

- Up to 200m Line of site wireless transmission range
- Fully weatherised (IP66)
- Maintains 5:1 safety factor
- Low rigging profile of 130mm
- 1200 hr battery life at transmission 1 per second
- Automatic sleep function after 300 seconds to preserve battery life if handheld or PC base station is not detected
- Although the measurement technology has the ability to resolve down to 1Kg. Due to limitations in the manufacture of the Crosby shackle bow, Mantracourt Specify an of accuracy of +/- 0.5% of current load or 15 Kg, whichever is the greater value.

The BWSHK has a measurement shackle pin up to 4750 Kg. The pin will hold a load 5 times over this however the pin measurement will be unreliable if the load of 4750Kg is exceeded.

Pack Contents

USB Base Station

Handheld Reader

Resource CD

Quick Start

This section will show you how to get the device working out of the box.
You will require 2 X AA alkaline batteries for each of the shackles as well as 2 X AA batteries for the handheld. We recommend using a quality alkaline battery to ensure optimum battery life, rechargeable batteries are not recommended.

Connecting Power

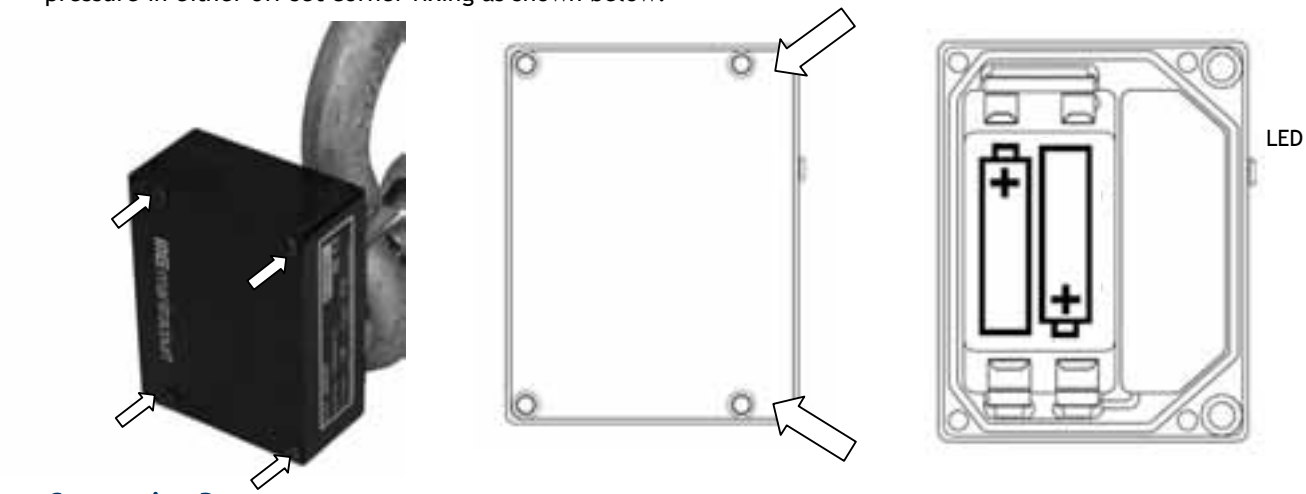
Handheld Display

Remove the two screws on the rear battery compartment. Insert two alkaline AA batteries. Refit the battery compartment cover. The handheld device is now switched on so should be turned off until the BWSHK are ready. To turn off hold down the power key until the display shows **BUSY** then release it.

BWSHK BroadWeigh Shackle

Opening the Case

The case lid is secured with four #2 Hexagon button head screws, remove the four screws. Remove the cover by either pushing the cover forward from the back using the holes on the back of the black case or by applying pressure in either off set corner fixing as shown below.



Connecting Power

Power is supplied by fitting 2 X ‘AA’ Alkaline 1.5 Volt batteries.

LED Indicator

The BWSHK is fitted with an LED to provide a visual indication of data transmission from the acquisition module inside. The LED flashes whenever a data transmission occurs. Modules are pre-configured to provide readings once per second.

Shackle Orientation & Identification

The shackle pin and bow are calibrated together, each bow is different and each pin and bow has a unique calibration. To maintain accuracy each pin and bow must be kept as a pair and not interchanged. The bow is marked with the ID of the pin it is associated with as shown.

The pin must be aligned in the same orientation with the bow as it was when calibrated to ensure optimum performance. The BroadWeigh shackle is designed to only fit together in one orientation, the anti rotational bracket will only fit around the bow shackle on the side with CE marking. This is the opposite side to the ID marking.

Basic Hand Held Operation

Turn the handheld on by pressing and holding the ⏻ symbol (on the right) until the display is active. This will wake the radio and measurement system in the shackle. The displayed value is in Kg and the shackle can measure up to 4750Kg over which OVERLOAD will be displayed.

The handheld display automatically switches 'on' the shackles as soon as they are in range. The handheld will then display the shackle with the strongest signal – in most cases the nearest shackle.

You can select a new shackle to display by pressing the ▶ key and the shackle data tag will be shown briefly before the reading is displayed. The data tag is the last 4 characters of the ID which can be found on the shackle label.

By pressing and holding the ▶ key, the shackle ID currently being measured will be shown.
The currently selected shackle LED will also change from flashing to permanently on.
The handheld can read from an unlimited number of shackles.
The shackles will return to sleep 30 seconds after the handheld is turned off or is taken out of range.

Basic PC Logging Software

BroadWeigh Resource CD

The BroadWeigh Resource CD included in the kit comes with two pieces of software:

- T24Log24 – Logging software for up to 24 BWSHK
- T24-Toolkit – for advanced configuration of any device

The kit also contains a USB base station which is used with the T24Log24 software contained on the resource software CD. To set up the software please follow these instructions:

Insert the CD. Then run **setup.exe** from the CD folder /T24Log24/.
Once the software is installed connect the USB base station and launch the software.

Main Window

The main window shows an LCD display mimic for each of up to 24 channels. The window is resizable but the contents just arrange themselves to fit without resizing.

Each channel is displayed with a title, the LCD mimic showing the value, a link quality indicator and battery low indicator as well as Zero button.

If communications with a module is lost the display turns red and the value is shown as -------

Pressing the **Zero** button will immediately tare the display so that the current value shows zero. You can remove a zero by holding the **Shift** key and clicking the Zero button again or by editing the Workspace.

NOTE: Some channels may show a button with **Reset** instead of **Zero** as a caption. These channels are peak or trough capture channels. See Configure Workspace section.

Menu Items

File

Open workspace - Displays a file open dialog window to allow you to select a previously saved workspace file. These files have a *.lws extension. Once a workspace is opened it will overwrite all existing workspace settings.

Save Workspace - Displays a file save dialog window to allow you to save the current workspace.

Exit - Close the program.

Edit

Configure Workspace - Opens the Configure Workspace Window. This is where you configure the logging software.

Sleep & Wake

Wake - Wake ALL modules on the same channel.

Sleep - Broadcast a sleep command to ALL modules on the same channel.

Logging

Start Logging - Start logging to a file. This will open a file save, dialog window to allow you to select the name and destination of the log file. For log file formats and other information see Logging.

Stop Logging - Stops a previously started log.

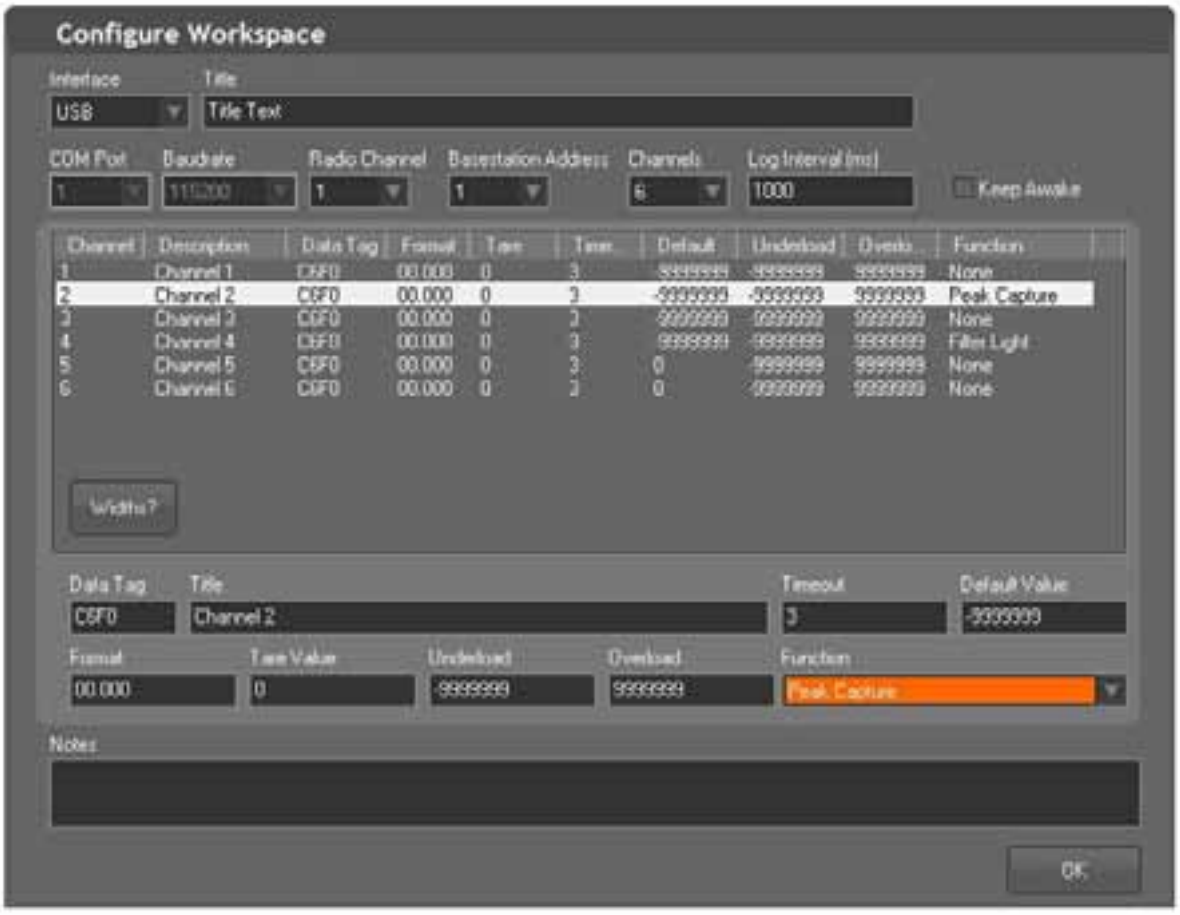
View Last Log - This will try and open the last logged file with the application that is associated with the .csv extension. On most computers this is Microsoft Excel.

About

Opens an about window which gives information on software and driver versions.

Configure Workspace Window

This is where you configure the entire display and logging experience. Once configured the workspaces can be saved and later loaded so that everything you need to repeat a previous log setup can be recalled instantly.



Interface - Select either USB or Serial depending on the type of base station connected.

Title - Enter a title for this workspace. this will appear in the title caption of the main window.

COM Port (serial base station only) - Select the COM port that the base station is connected to.

Baudrate (serial base station only) - Select the baudrate that the base station is configured to. This can have a big effect on the achievable log rates. You may need to increase the baudrate for fast acquisition speeds.

Radio Channel - Select the radio channel that matches the acquisition devices. When you close this window the base station will be switched over to the selected channel. All shackles are by default set to channel 1.

Base Station Address (serial base station only) **-** Select the number address of the connected base station. This is only useful for cases where multiple base stations are connected. The default of 1 should be suitable in most cases.

Channels - Select the number of channels you want to connect to. This can range from 1 to 24. As you change the number of channels you will see that the number of lines in the channel list change.

Log Interval - Set the desired interval between logs in milliseconds.

Notes - Any notes you enter here are for your reference and can be seen when you next open this dialog window.

Channel List - This list shows one line for each channel. To edit the settings click on a line. The fields below will be updated to show the settings of the selected channel.

Channel - This indicates the channel number.

Description - Enter a caption to appear on the main window and in the column header of the logged data.

Data Tag- Enter the data tag of the data you want to be associated with this channel.

Format - Specify a format for the main window display and also to format the data recorded into the log file. Just indicate the decimal point position and number of decimal places by using a period and zero characters. For example: 0.00 or 000.00000

Tare Value - If you had clicked the zero button on the main window, the value used as the tare would be shown here. i.e. this value is subtracted from the value reading from the module to give the value displayed and logged. You can manually zero this to remove the zero or enter a manual offset value.

Timeout - Enter a time in seconds, that when exceeded with no incoming signal from this module, causes any logged data to log the Default value and also to display this channel in solid red background with -------- shown instead of a value.

Default - If no data is received from this channel, this is the value that will be logged to the file.

Underload - Enter a net limit below which the channel display will flash red.

Overload - Enter a net limit above which the channel display will flash red.

Function - Here you can select a function to apply to this channel.

> **None** - No function. Value is displayed as received.
>
> **Sum Previous Channels** - This will show the sum of all previous channels. The data tag entry will be ignored.
>
> **Peak Capture** - The channel will only display the peak value (max) from the designated module. The button for this channel has a Reset caption and clicking this will reset the displayed peak to the current module value.
>
> **Trough Capture** - The channel will only display the trough value (min) from the designated module. The button for this channel has a Reset caption and clicking this will reset the displayed peak to the current module value.
>
> **Filter Light** - A light filter will be applied to the designated module value. This will smooth sharp transients.
>
> **Filter Medium** - A medium filter will be applied to the designated module value. This will smooth sharp transients but slow down changes.
>
> **Filter Heavy** - A heavy filter will be applied to the designated module value. This will smooth out the display at the expense of slow signal changes..

Press the OK button when finished. Please note that the changes will only affect the current session and will be lost when you close the program unless you choose to Save Workspace from the File menu on the main window.

T24-HR-BW Operation

Keys

Press and hold the power key for approximately 2 seconds then release the key. This will toggle between turning the handheld on and off.
Can also be used, by giving a quick press, to reset the Auto-Sleep delay.

Selects the next module to view.
Pressing and holding will display the currently viewed module Data Tag without moving to the next module.

Indicators

SIG LOW	The radio signal from the acquisition module is low. The device is still functioning but the limit of the range may be near. Communications may start to deteriorate when this indicator is visible. Until ------ is displayed the communications is still OK and the display can be relied on for accuracy. **Note**: Even with a degraded signal the display value will always be correct.
BATT LOW	The batteries in the handheld are low and need to be replaced.
REMOTE ERROR	The BroadWeigh device module has an error that the handheld does not recognise.
REMOTE BATT LOW	The battery or supply to the acquisition module is low.

Errors

Displayed on handheld LCD.

Error 1	The BroadWeigh device has a strain gauge input and is in shunt cal mode. An external device has placed the acquisition module in Shunt Calibration mode so rather than display a misleading reading this error is displayed instead. Modules such as the BWSHK support this error type.
Error 2	Input integrity error. The acquisition module has found a problem with the input. There may be open or short circuits. Rather than display a misleading reading this error is displayed instead.
Overload	A user settable value which when exceeded causes this message to be displayed. This is set to 4750 Kg for the BWSHK inputs.

Installation Considerations

Overview

Radio performance at microwave wavelengths is very dependent upon the operating environment; any structure within the operating region of the radios will give rise to three effects:

Obscuration. Obscuration will result in reduced range and occurs when an obstruction masks the line-of-sight between radios.

Aberrations to the horizontal and vertical space patterns. Distortion of these patterns may occur if structures or objects are placed in the near or intermediate field of the antenna. The effect will be to distort the coverage patterns, adversely affecting range and link quality.

Reflection. Any object placed in line-of-sight of the transmit antenna will result in signals arriving at the receiver by an indirect path. Degradation of performance due to reflection (multipath effects) appears as reduced range or poor link quality.

Any of the above will cause poor RSSI figures, an increase in the packet loss rate and in extreme cases complete loss of signal. Fortunately, if consideration is given to these effects at the integration stage then a good quality link will be obtained.

Interference

The Broadweigh system uses a proprietary protocol which has been tested with a variety of other 2.4GHz devices including Wi-Fi and Bluetooth. Sources of interference which have been identified include high power wireless camera transmitters which are not approved for use in countries which follow FCC and ETSI. Using the T24-ToolKit spectrum analyser (detailed on page 13) will allow users to identify source of interference.

Antenna Orientation

For the maximum range the shackle module and handheld should be orientated as shown.
The sensitivity to the radio transmission will be reduced if the BroadWeigh device is oriented in a vertical or portrait position.

Guidelines for installation:
When planning installations ensure that line-of –sight between nodes is maintained and that objects or structures are kept at least one metre away from antennae wherever possible.

To avoid poor link quality between a BWSHK and handheld device ensure that the BWSHK is mounted so that the Mantracourt logo faces the handheld. Improvement may also be obtained by altering the height above ground of the BWSHK; a small increase or reduction in antenna elevation will often improve reception.

Battery

Use a pair of alkaline AA batteries. Due to the higher voltage requirements of this device NiMh and NiCad batteries are not recommended.

T24 Toolkit

Installation

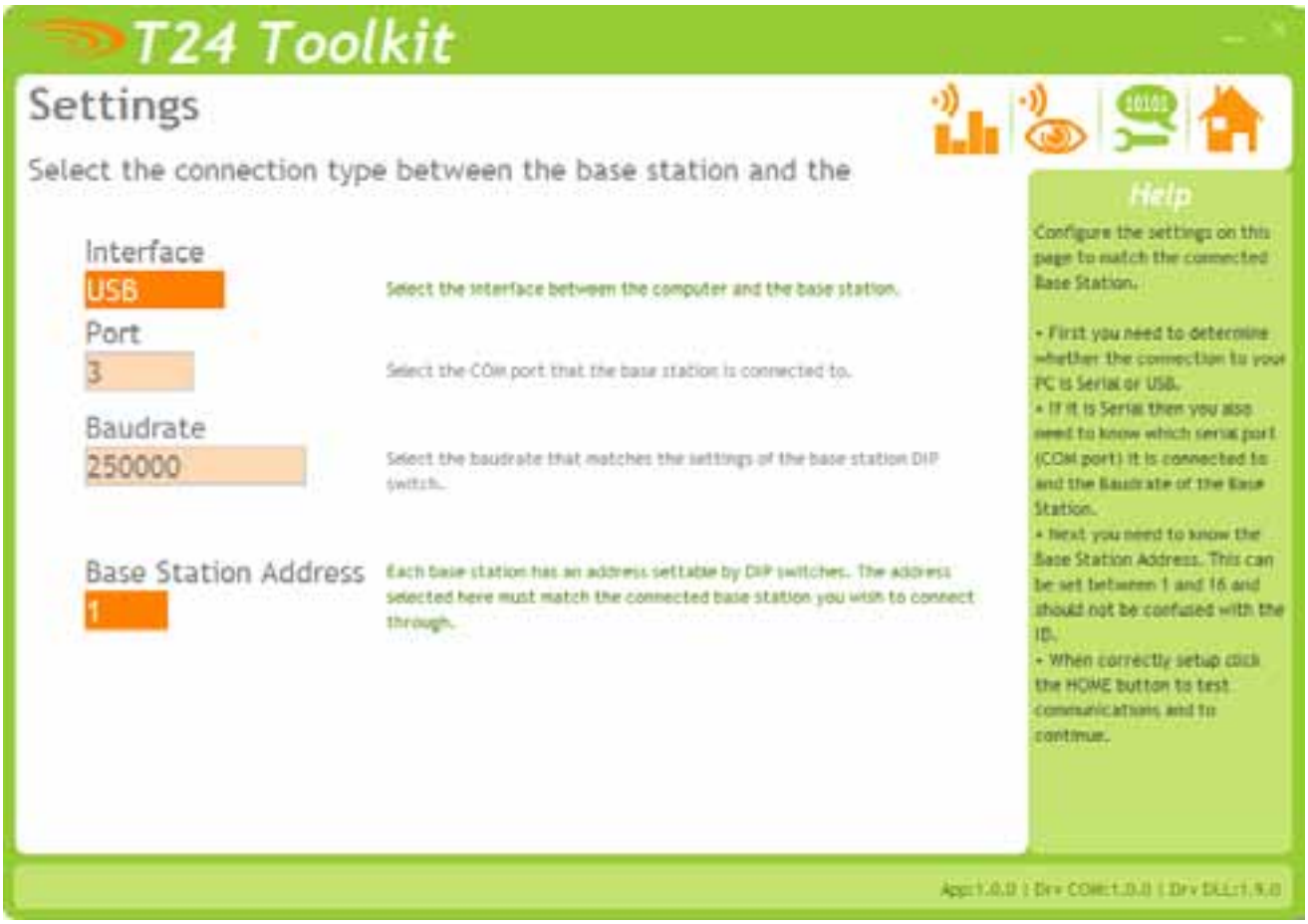
To configure the devices we must use the **T24 Toolkit** software application. This can be downloaded from our web site or may be shipped with your products.
Install this on a PC or laptop.
Run /T24-TK/setup.exe and follow the prompts to install the software.

The T24 Toolkit provides a means of simple configuration of the T24-HR-BW handheld and BWSHK along with useful tools to aid integration. Calibration of the acquisition module is also provided.

Run the T24 Toolkit software application.

PLEASE NOTE: Depending on which acquisition module is selected the screenshots may vary slightly. This will generally be in naming of units and device descriptions. The screenshots shown are those shown when a T24-SA strain gauge acquisition module is connected.

Setup Base Station Communications


T24 Toolkit
Settings
Select the connection type between the base station and the
Interface
USB
Select the interface between the computer and the base station.
Port
3
Select the COM port that the base station is connected to.
Baudrate
250000
Select the baudrate that matches the settings of the base station DIP switch.
Base Station Address
1
Each base station has an address settable by DIP switches. The address selected here must match the connected base station you wish to connect through.
Help
Configure the settings on this page to match the connected Base Station.
• First you need to determine whether the connection to your PC is Serial or USB.
• If it is Serial then you also need to know which serial port (COM port) it is connected to and the Baudrate of the Base Station.
• Next you need to know the Base Station Address. This can be set between 1 and 16 and should not be confused with the ID.
• When correctly setup click the HOME button to test communications and to continue.

Select **USB** as the interface and select 1 as the Base Station Address.
In the toolkit all items that can be changed by the user are coloured orange.
To change a value just click on the relevant orange item. You will then be presented with a new dialog window allowing you to change the value.
This may use a slider, text box or list to allow your new value to be entered.

Click the Home button to attempt communications with the base station.
If no communications can be established the toolkit will remain on this page. You will need to check that the base station is powered and that it is connected to the converter correctly.

Home

T24 Toolkit
Home
Ready to connect to your device now!
To connect to your device we need to pair to it. Pairing means you do not need to know anything about channels, ID or any other information about your device.
To pair you must:
· Remove the power from your device.
· Initiate the pair by clicking the button below.
· Re-apply the power to the device.
When applying power be careful to do this cleanly because if the device is powered up with an intermittent connection it may reset during pairing and result in poor or no communications.
Pair
Help
This Home page is where you begin your connection to your device.
You must be able to access its power supply so you can remove and reapply it.
The device you want to connect to must be the only device you reapply power to.
When pairing to a device the base station settings are changed to match those of the remote device.
[To connect to the base station hold the Shift key while clicking the Pair button]
Connected to Base Station ID FFC5D8

We now have successful communications with the base station so we can now pair with our device or we can select the Spectrum Analyser mode or Data Provider Monitor mode.

To connect to our device we will pair. This is achieved by power cycling the device. Pairing removes the need to know the radio settings of the device you are connecting to and also ensures that it is in a suitable state for configuration.

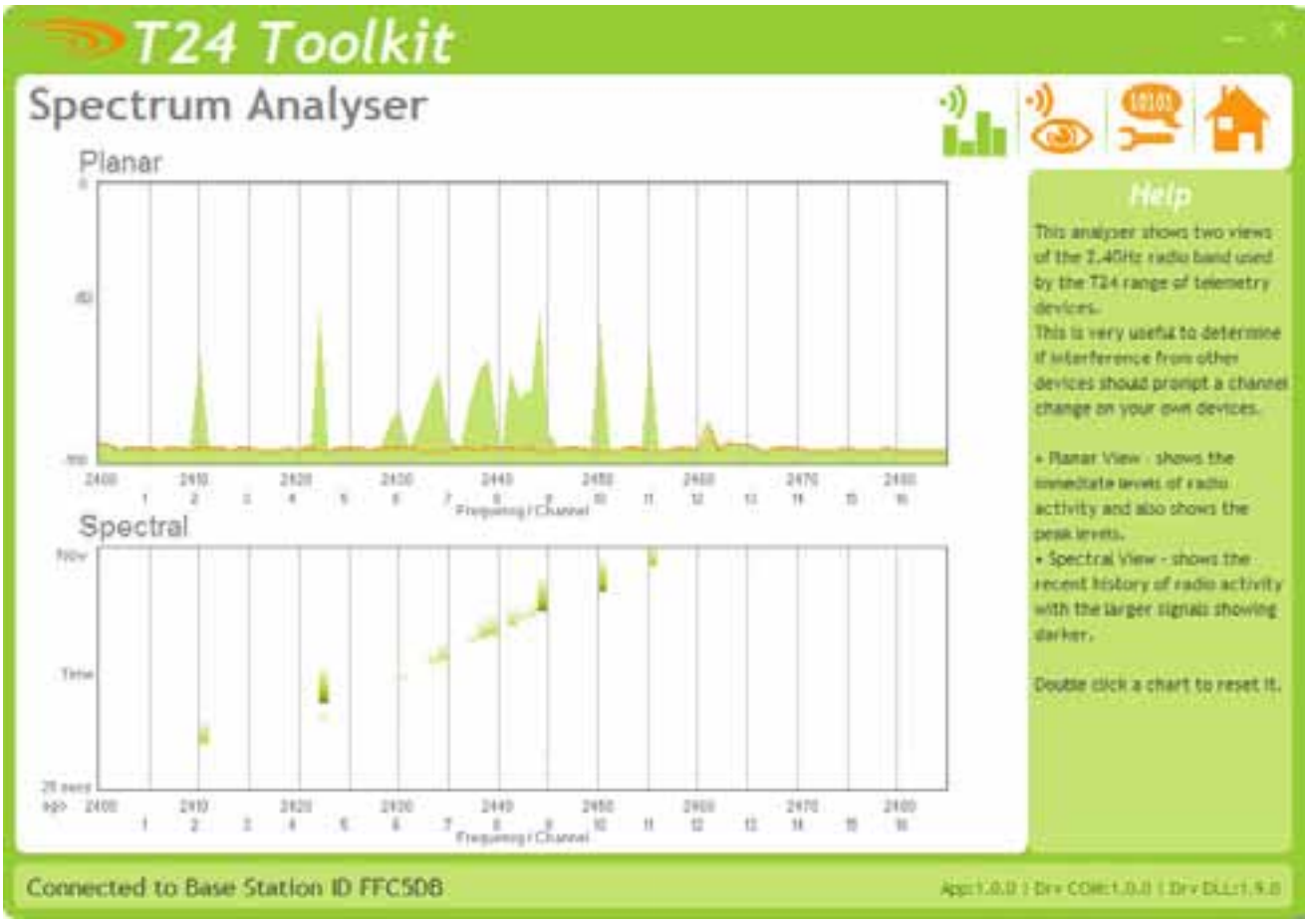
Pairing Procedure

- Remove at least one battery from the handheld module or BWSHK
- Click the Pair button on the toolkit.
- You now have 10 seconds to replace the handheld batteries.

If you connect successfully the toolkit will change to the Information page.
If the pairing fails try again.

NOTE: Pairing with the toolkit will **not** change the radio configuration settings of the connected device.

Analyser


T24 Toolkit
Spectrum Analyser
Planar
Spectral
Help
This analyser shows two views of the 2.4GHz radio band used by the T24 range of telemetry devices.
This is very useful to determine if interference from other devices should prompt a channel change on your own devices.
• Planar View - shows the immediate levels of radio activity and also shows the peak levels.
• Spectral View - shows the recent history of radio activity with the larger signals showing darker.
Double click a chart to reset it.
Connected to Base Station ID FFC5D8

The analyser page is provided as a tool and will not normally be needed unless you plan to change channels and want to find the best channel to select, or to diagnose poor communications issues.

This page shows the radio signal levels detected across all the channels available to the T24 series of devices. Using this tool may help in detecting noisy areas and allow you to decide on which channels you may want to use.

The above charts show the traffic from a Wi-Fi network and it can be seen to be operating over channels 6 to 9 and it would be best (though not essential) to avoid using these channels.

Data Provider Monitor

T24 Toolkit
Data Provider Monitor
Data Tag Total Per sec LQI Value
C629 18 3 100 0.0160147
C623 58 10 100 0.0129487
C628 18 3 100 0.0218671
C62C 18 3 100 0.0152698
C627 17 3 100 0.0172869
C624 17 3 100 0.0130830
Help
This page allows you to monitor Data Provider packets.
Data Provider packets are what acquisition devices transmit periodically.
You have the option of logging these to a comma seperated value (CSV) file.
Select the devices you wish to log from the above list be checking them. Pressing the Start Logging button will allow you to select a filename to log the data to.
View Last Log
Start Logging
Connected to Base Station ID FFC5D8

T24 acquisition devices normally operate in low power mode and periodically transmit Data Provider packets This page shows all detected Data Provider packets which may be useful for checking that a device is operational.

NOTE: When the toolkit connects to a device to enable configuration it will usually inhibit the transmission of Data Provider packets.

The Start Logging button will ask for a filename and proceed to log the received data to a CSV file in the following format:

```
Data Tag, Elasped mS, Value
```

The View Last Log button will launch the application associated with CSV files and open the last logged file.

Advanced Users Only

The following sections of the manual detail the configuration of the individual modules which are Mantracourt Electronics OEM products. An understanding of these configuration options is not necessary to use the BroadWeigh System. These configuration options include increasing data rates, sample times, sleep and wake times. Please be aware altering these settings can result in your system not behaving as expected. If you have a specific requirement that is not fulfilled by the current configuration please contact your local distributor who can advise you initially.

Common Configuration Pages for Both T24-HR and BWSHK

Channel and Encryption

T24 Toolkit
Channel and Encryption
Channel
01
Encryption Key
00000000000000000000000000000000
The encryption key is 32 hex characters long.
NOTE: Changing the channel and key will not affect the device until it has been power cycled.
If you have a handheld device and one or more acquisition devices and you want to change the channel and keys for all you could do either of the following:
Connect this toolkit to each of the devices in turn and change the channel and key settings.
Connect to just the handheld device and set the channel and key as required. Next using the pair function in the handheld connect to each acquisition device to change its settings to match those of the handheld.
Connect to one device and change its channel and key as required. Click the Home button and then re-pair to that device. The base station will now match its settings to that device. Return to this page and click the Advanced button. From here you will be able to quickly change the settings of multiple devices to match the base station just by pairing with each one in turn.
Advanced
Help
Here you can change the channel and encryption key for the connected device.
NOTE: The device will need power cycling before these changes take effect.
If you power cycle the device you will need to click the HOME button and pair the device again with this application.
Connected to T24-HS of ID FFFCFB

Here you can change the channel and encryption key for the acquisition module.
If you want to change the channel of an acquisition module and T24-HR pair there is no need to change both devices.
Simply pair to the handheld and change its channel and key.
Now perform pairing to the acquisition module from the handheld and the acquisition module will be configured to match the handheld.

Items you can change:

Channel	Select a channel between 1 and 16. The default is channel 1. You can use the Spectrum Analyser mode to determine a good clean channel to use. NOTE: Channel 16 is used to negotiate pairing so avoid this channel if possible.
Encryption Key	Only devices with identical encryption keys can communicate. You can isolate groups of devices on the same channel or just use the key to ensure the data cannot be read by somebody else.

Save and Restore

T24 Toolkit
Save and Restore
Save
Query the device for its parameters and save these to a configuration file on your computer or network location.
Restore
Load a previously saved configuration file into the currently connected device.
NOTE: As all parameters are restored you will overwrite the existing device calibration information.
Help
This page allows you to save the configuration of the connected device to a disk file on your computer.
This file may then be used to restore the configuration to the same device or to clone the configuration onto another device.
Connected to T24-HS of ID FFFCFB

Here you can save the device settings to a file on your PC so that they can be later loaded back into the same or different device.

Items you can change:

Save	Click this button to open a file dialog window to allow you to select a filename and location to save the configuration file to. All configuration information including calibration data will be saved to the file. The file extension is **tcf**.
Restore	Click this button to open a file dialog window to allow you to select a filename and location of a previously saved file to load into the connected device. All configuration information **including** calibration data will be overwritten. The file extension is **tcf**.
Advanced Settings	Click this button to enter the Advanced Settings Page. Here are settings which do not normally require changing.

T24-HR Information

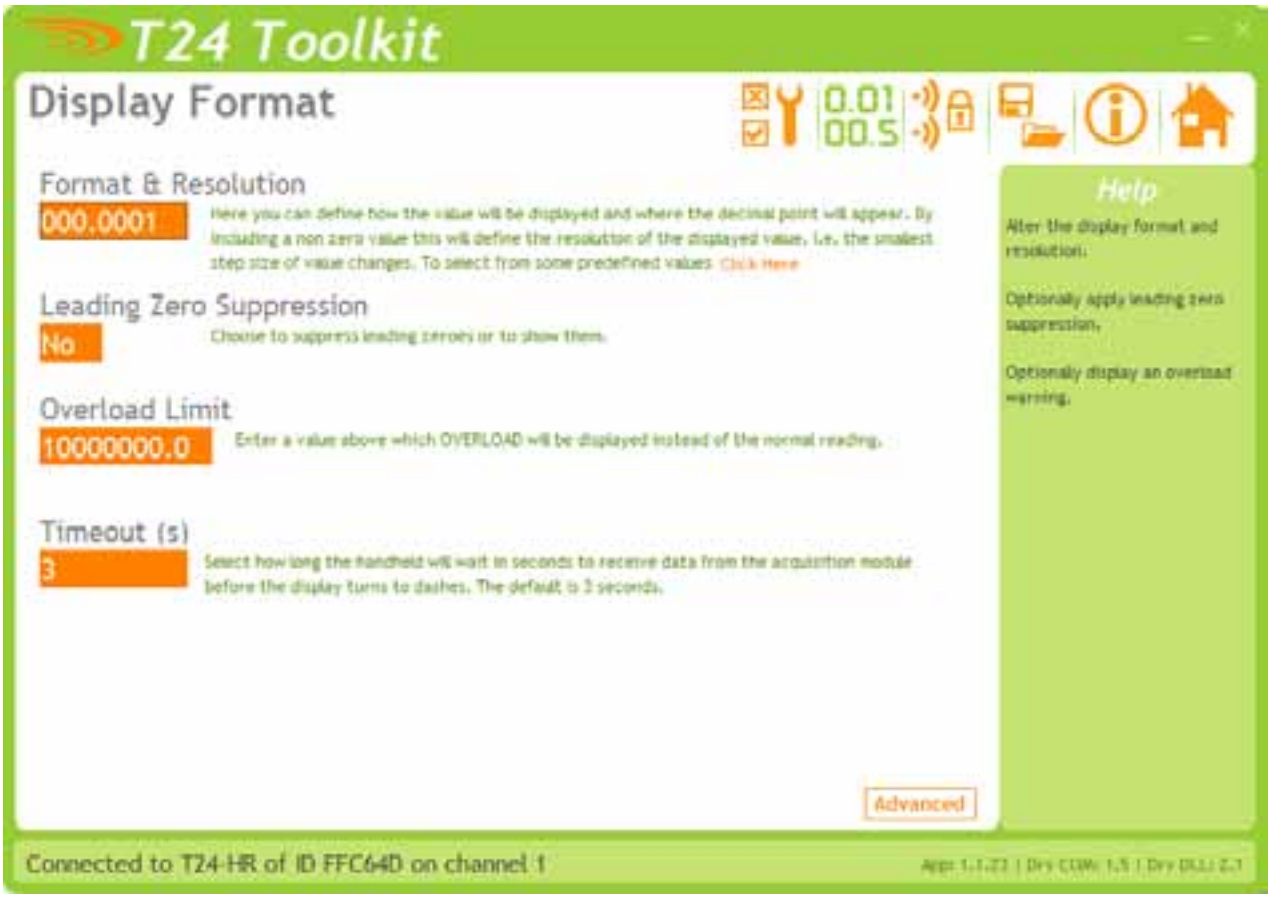
T24 Toolkit
Information
Help
Here you can view information about the device.
You can also allocate a descriptive name to aid future identification.
Pressing F1 or double clicking the module image will display the T24-HR manual if it can be located.
ID: FFC64D
Model: T24-HR
Firmware Version: 1.00
Radio Module Firmware Version: 1.4
Name: T24-HR
Handheld Display Roaming
Connected to T24-HR of ID FFC64D on channel 1

Once successfully paired to a device this page is displayed.
This page shows you information about the connected device.

Items you can change:

Name — You can enter a short description which may help you recognise this device in the future.

T24-HR Display Format

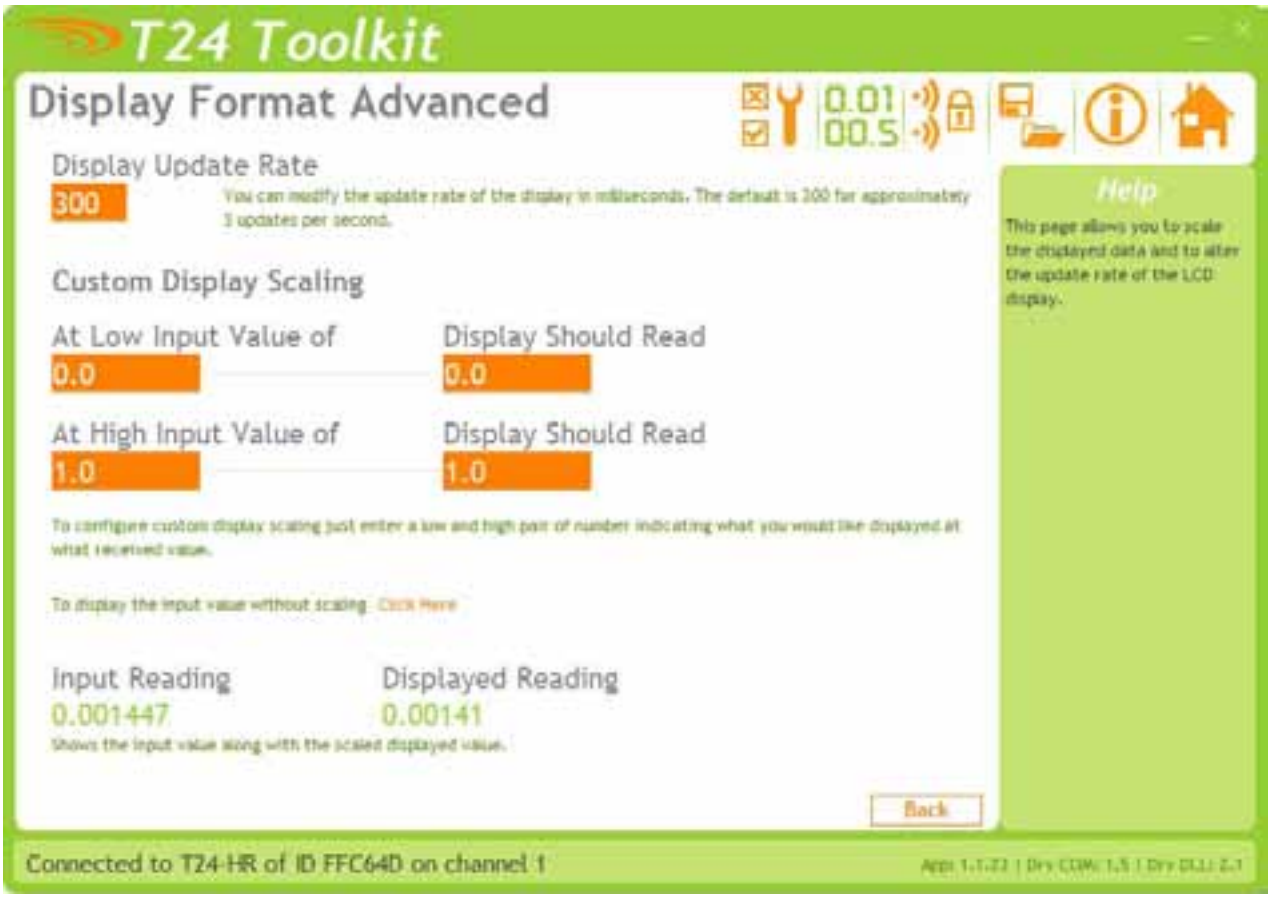

T24 Toolkit
Display Format
0.01
00.5
Format & Resolution
000.0001
Here you can define how the value will be displayed and where the decimal point will appear. By including a non zero value this will define the resolution of the displayed value, i.e. the smallest step size of value changes. To select from some predefined values Click Here
Leading Zero Suppression
No
Choose to suppress leading zeroes or to show them.
Overload Limit
10000000.0
Enter a value above which OVERLOAD will be displayed instead of the normal reading.
Timeout (s)
3
Select how long the handheld will wait in seconds to receive data from the acquisition module before the display turns to dashes. The default is 3 seconds.
Help
Alter the display format and resolution.
Optionally apply leading zero suppression.
Optionally display an overload warning.
Advanced
Connected to T24-HR of ID FFC64D on channel 1

Here you can adjust the display.

Items you can change:

Format & Resolution	Here you can define how the values are displayed on the LCD. There are 7 digits available and you can define where the decimal point is shown by entering text where a zero indicates a numeric digit position. When the data is being displayed the number of decimal places you define may be overridden as the display will always show the correct number of integer digits. Example: If you set the format to 000.0000 and the value to display is 1000.1234 the display will show 1000.123 You can also define the resolution, which is the block size of changes to the display. Example: If you enter the format as 000.0005 the display will only change in steps of 0.0005 which can be used to mask noisy digits at high resolutions.
Leading Zero Suppression	This can be turned on or off and will suppress leading zeroes when on. Example: If the display reads 000.123 with leading zero suppression turned off it will display 0.123 when turned on.
Overload Limit	You can enter a limit here above which **Overload** will be shown on the display instead of the actual value. Enter zero to disable this feature.
Timeout	Enter the timeout in seconds. This sets the time allowed without any data arriving from the viewed module before all dashes are displayed on the LCD. Should be at least 3 times the interval between the data being transmitted by the acquisition module.
Advanced	This opens the advanced page where you can scale the displayed data.

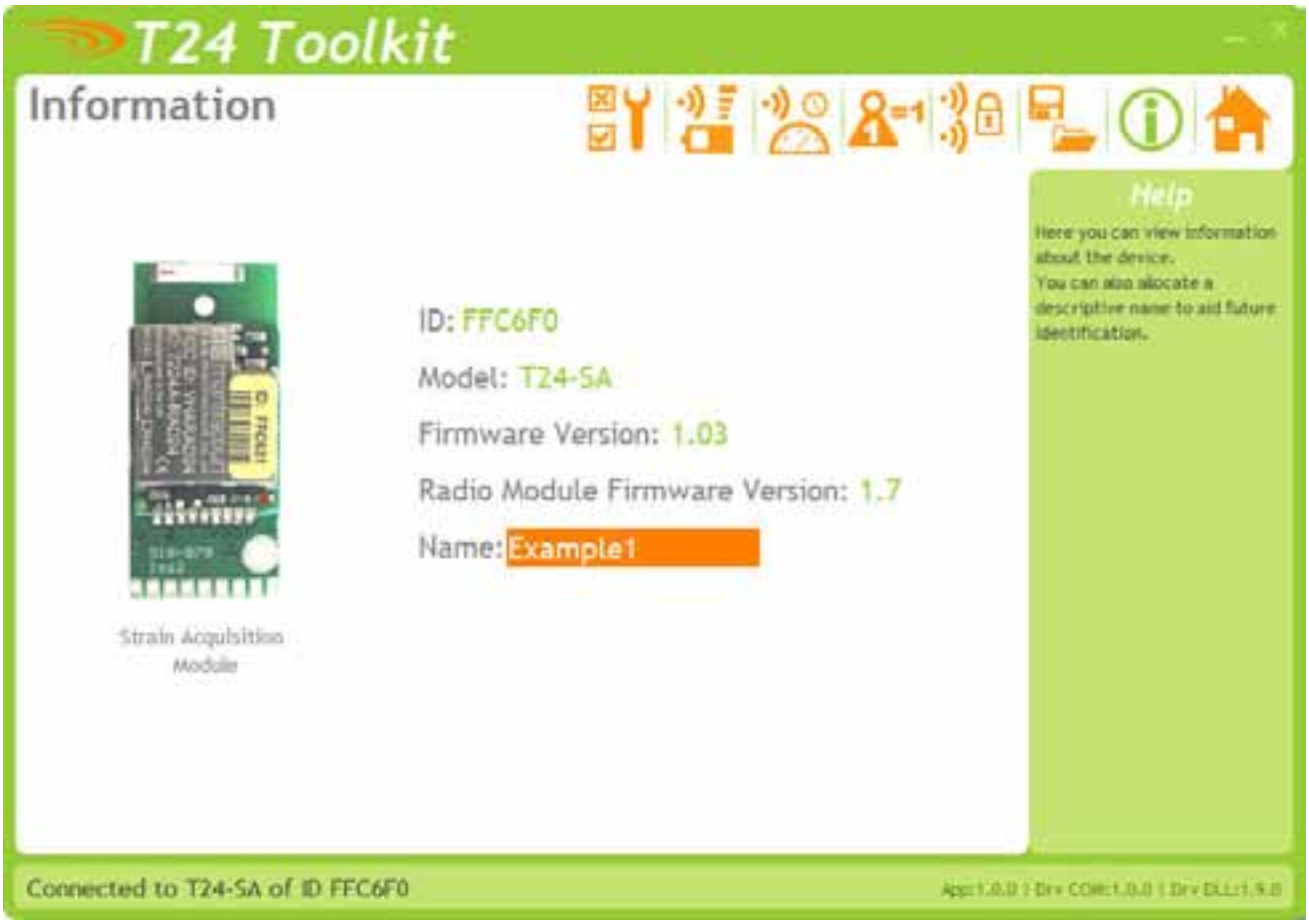
T24-HR Display Format Advanced Settings



Here you can adjust the display update rate and also scale the displayed data. This may be used, for example, to convert the data from a T24-SA calibrated in Kgs so that the handheld display shows Lbs.

Items you can change:	
Display Update Rate	Enter the interval in milliseconds between display updates. The default is 300 milliseconds. i.e. 3 updates per second.
Custom Display Scaling	This can be used to change the displayed value to a different unit or to otherwise scale it. You simply enter the original and required values at a low and high point. Example: If a T24-SA was supplying data in Kgs and you wanted to show tonnes. You would keep both the low points at zero. Enter **At High Input Value** of 1000 and **Display** Sh**ould Read** Value of 1.

BWSHK Information

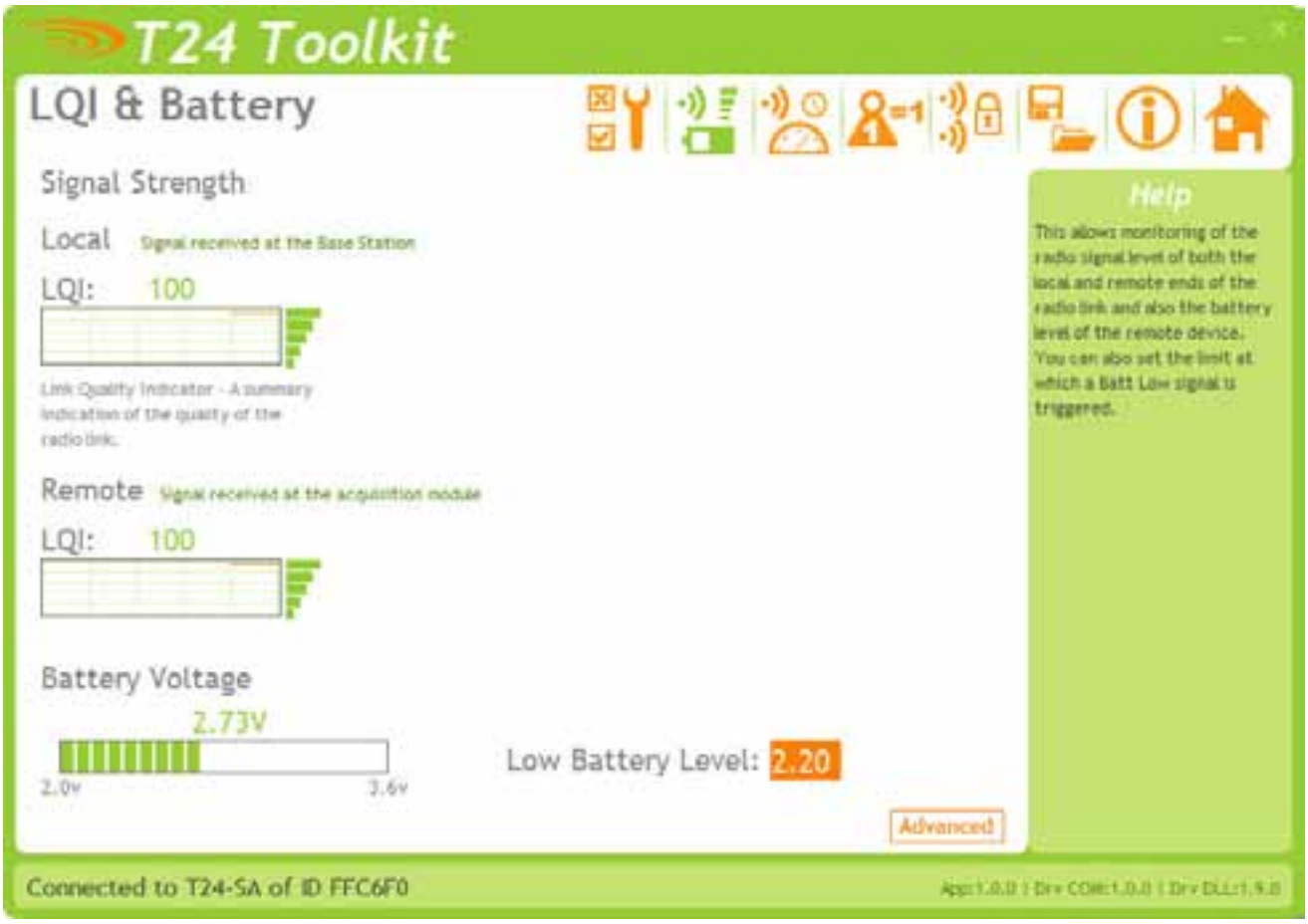


Once successfully paired to a device this page is displayed.
This page shows you information about the connected device.

Items you can change:

Name — You can enter a short description which may help you recognise this device in the future.

BWSHK Battery and Radio Levels


T24 Toolkit
LQI & Battery
Signal Strength
Local
Signal received at the Base Station
LQI: 100
Link Quality Indicator - A summary indication of the quality of the radio link.
Remote
Signal received at the acquisition module
LQI: 100
Battery Voltage
2.73V
2.0v
3.6v
Low Battery Level: 2.20
Advanced
Help
This allows monitoring of the radio signal level of both the local and remote ends of the radio link and also the battery level of the remote device. You can also set the limit at which a Batt Low signal is triggered.
Connected to T24-SA of ID FFC6F0

Here you can see the voltage of the battery and the radio signal levels at the base station and the remote acquisition module. This simple view gives an LQI value which stands for Link Quality Indicator. This value will range from 0 to 100 and within this band you should still achieve communications. As the level drops towards zero communications may become intermittent but still achievable.

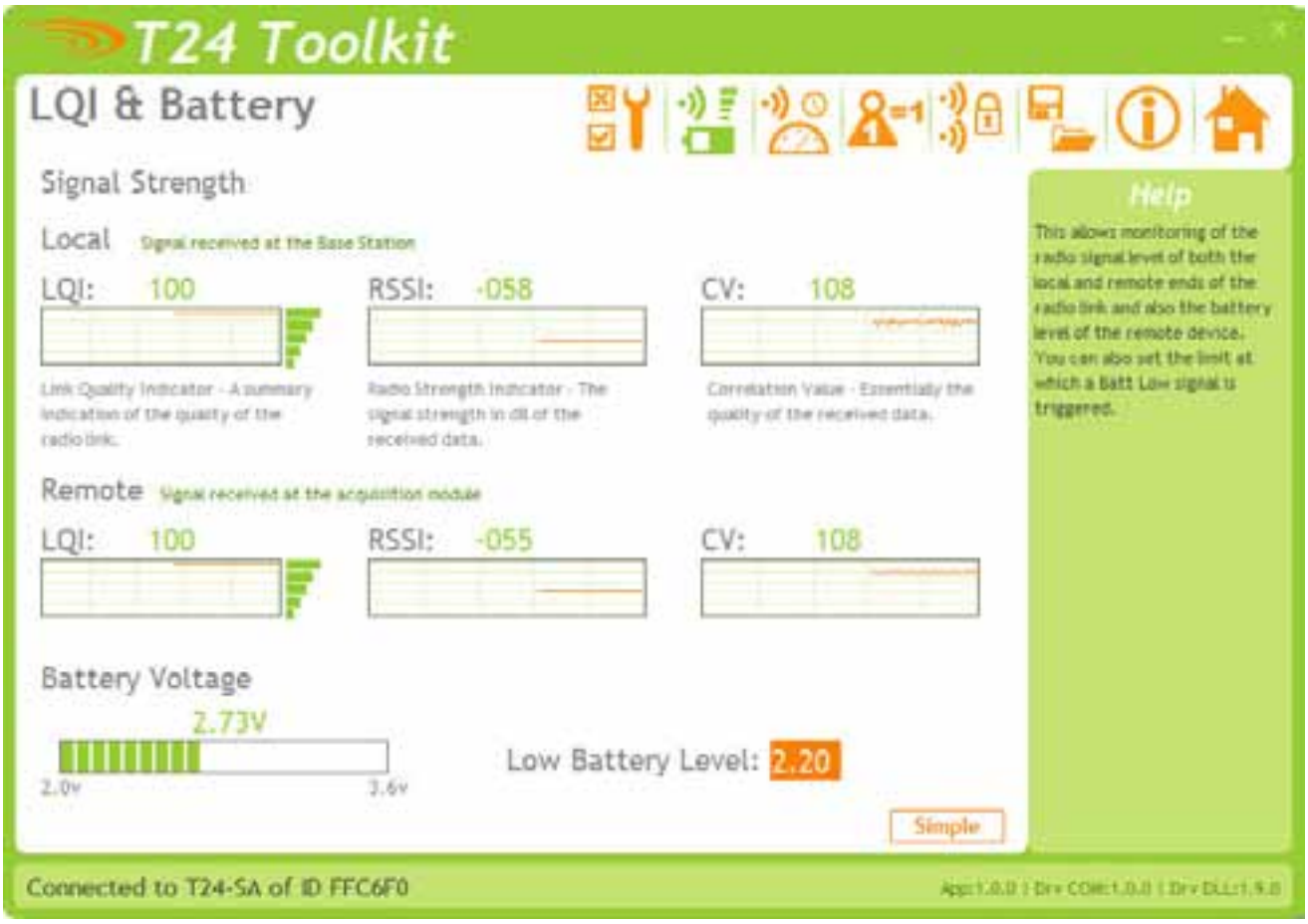
You can set the level at which the acquisition module reports a low battery.
If the battery voltage is below the Low Battery Level the bar will be coloured orange.

Items you can change:

Low Battery Level	Click this item to set the battery low level.

Clicking the Advanced button will give more detailed information on the RSSI and CV levels of the received radio packets.

BWSHK Battery and Radio Levels Advanced Settings


T24 Toolkit
LQI & Battery
Signal Strength
Local
Signal received at the Base Station
LQI: 100
RSSI: -058
CV: 108
Link Quality Indicator - A summary indication of the quality of the radio link.
Radio Strength Indicator - The signal strength in dB of the received data.
Correlation Value - Essentially the quality of the received data.
Remote
Signal received at the acquisition module
LQI: 100
RSSI: -055
CV: 108
Battery Voltage
2.73V
2.0v
3.6v
Low Battery Level: 2.20
Simple
Help
This allows monitoring of the radio signal level of both the local and remote ends of the radio link and also the battery level of the remote device. You can also set the limit at which a Batt Low signal is triggered.
Connected to T24-SA of ID FFC6F0

LQI value which stands for Link Quality Indicator. This value will range from 0 to 100 and within this band you should still achieve communications. As the level drops towards zero communications may become intermittent but still achievable.

RSSI is effectively the received dB level which will range from about -30 which is a good signal to -90 which is a weak signal.

CV is the correlation value and indicates how well the signal can be decoded. This ranges from 55 which is a poor quality signal and 110 which is an excellent signal.

BWSHK Data Rates and Quality

T24 Toolkit
Data Rate
Transmit Interval (mS)
333
Enter the interval between taking a measurement and transmitting the result. Default = 300
Sample Time (mS)
5
The longer the sample time the more accurate the readings but the less life will be achievable from the battery. Default = 5
Low Power Mode
Yes
When Low Power mode is active the device sleeps between transmissions so battery life is vastly increased. Default = Yes
Battery Life Guide
Battery Type
Select a common battery type or enter a custom capacity.
2 X Alkaline AA Cell 1.5V (Varta 4006)
Usable Capacity (Ah)
2.3
Sensor Impedance (Ohms)
1000
Usage Per 24 Hour Period (Hours)
4.00
Noise Free Resolution: 15.5 bits or 1:50,000
Battery Life: 5 months and 23 days
Help
Here you can adjust data rates and quality and see the effect your choices have on battery life.
The battery life guide is only an indication of battery life and there are many factors that can affect this which are not accounted for here.
The guide assumes ideal operating conditions at 20 degrees centigrade and that capacitor modules are fitted when using alkaline batteries.
Please refer to device manual for more information.
Connected to T24-SA of ID FFC6F0

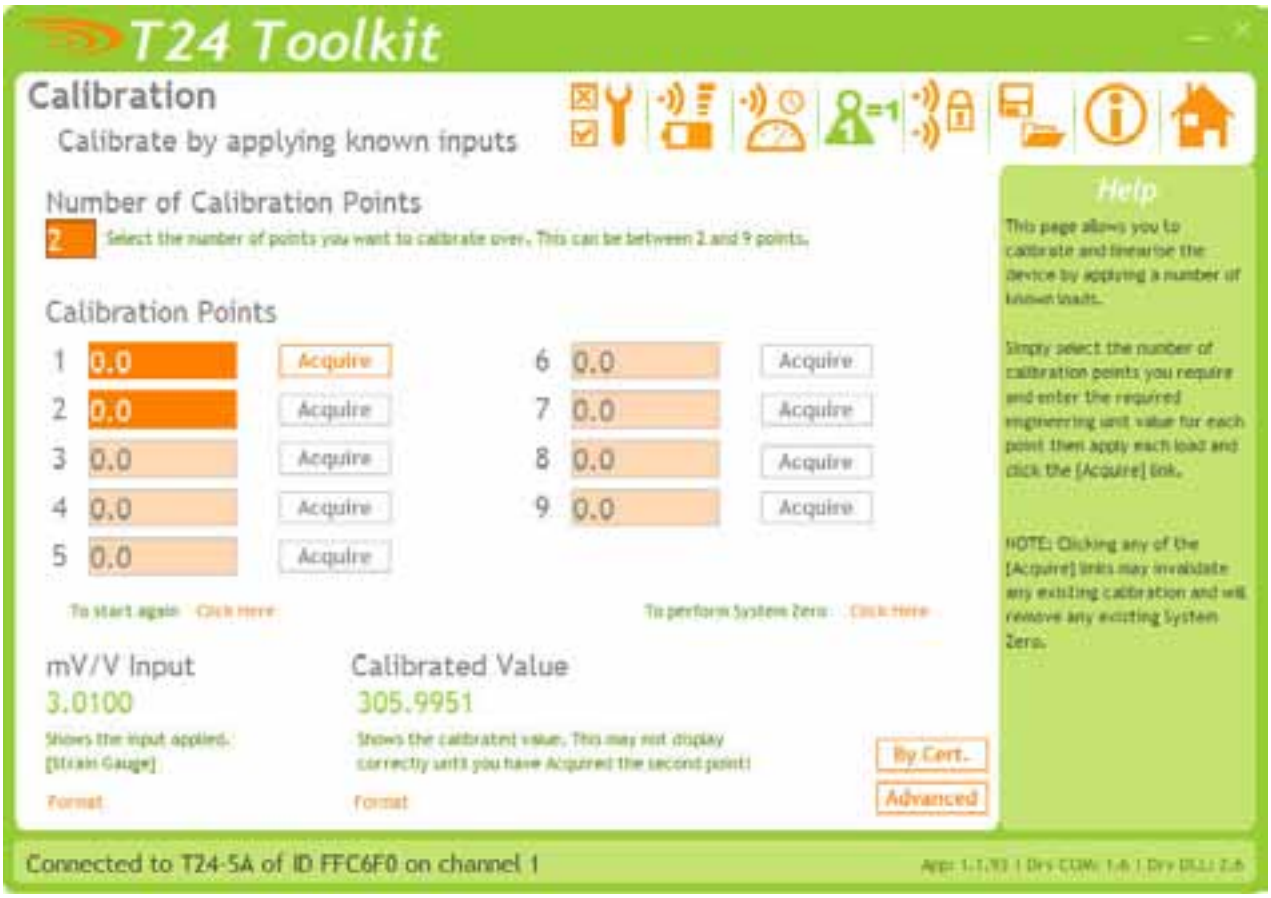
This page allows you to select the rate at which data is transmitted from the acquisition module and the quality. By selecting low power mode and entering some other information the toolkit will also give guides on achievable battery life.
Note that the battery life calculator is assuming the best case scenario which is at 20°C and that the battery has a suitable low internal resistance or that a suitable capacitor is fitted across the battery. See battery details in the Installation section.

Items you can change:

Transmit Interval	Enter the transmission rate in milliseconds. The default is 300 giving approximately 3 per second which is ideally suited to reading on a handheld. You may want to slow this down to achieve longer battery life.
Sample Time	This is the length of time in milliseconds that the input is sampled before the value is transmitted. This can vary between 5 milliseconds and close to the Transmit Interval. A shorter sample time means that the device is awake for less time so battery life is increased but at the expense of a reading with less noise free resolution. You can vary this to see the effect on battery life and noise free resolution.
Low Power Mode	Unless the acquisition module is non battery powered this should be set to Yes. In between transmissions the acquisition module will enter sleep mode which, for some modules such as the strain gauge acquisition module, will have a massive effect on battery life. A Reason for **not** using Low Power Mode would be if using the device in a Master-Slave arrangement with PC for example.

Battery Type	This is not a parameter of the device but information used by the battery life guide. You can choose from some preset batteries or choose custom to allow you to select your own battery capacity. See below. This will also offer to change the Battery Low Level if the level suitable for the chosen battery is not the level currently set.
Usable Capacity	This is not a parameter of the device but information used by the battery life guide. This is the capacity of the battery in Amp Hours and has a profound effect on battery life calculations. This capacity needs to be calculated from battery manufacturer's data sheets to take into account that we can only use batteries down to 2.1 Volts so in the case of twin AA cells this would be 1.05 Volts. Generally the usable capacity will not be as high as that advertised by the battery manufacturer. Temperature and internal resistance of the battery are not taken into account in the guide.
Sensor Resistance	This is only available for certain acquisition modules. This is not a parameter of the device but information used by the battery life guide. Enter the resistance of the connected strain gauge in Ohms.
Usage Per 24 Hour Period	Enter the number of hours per 24 hour period that the T24-HS handheld will be turned on and communicating with an acquisition module.

BWSHK Calibration


T24 Toolkit
Calibration
Calibrate by applying known inputs
Number of Calibration Points
2
Select the number of points you want to calibrate over. This can be between 2 and 9 points.
Calibration Points
1 0.0 Acquire
2 0.0 Acquire
3 0.0 Acquire
4 0.0 Acquire
5 0.0 Acquire
6 0.0 Acquire
7 0.0 Acquire
8 0.0 Acquire
9 0.0 Acquire
To start again Click Here
To perform System Zero Click Here
mV/V Input
3.0100
Shows the input applied. [Strain Gauge]
Format
Calibrated Value
305.9951
Shows the calibrated value. This may not display correctly until you have Acquired the second point!
Format
By Cert.
Advanced
Help
This page allows you to calibrate and linearise the device by applying a number of known loads.
Simply select the number of calibration points you require and enter the required engineering unit value for each point then apply each load and click the [Acquire] link.
NOTE: Clicking any of the [Acquire] links may invalidate any existing calibration and will remove any existing System Zero.
Connected to T24-SA of ID FFC6F0 on channel 1

Here you can calibrate the acquisition module and set a system zero if required.
This simple page allows semi-automated calibration where you can apply known inputs to calibrate.
This calibration includes linearization and is automatically applied.
See later for **By Cert** and **Advanced** page where you can adjust individual gains and offsets.

Calibration Process

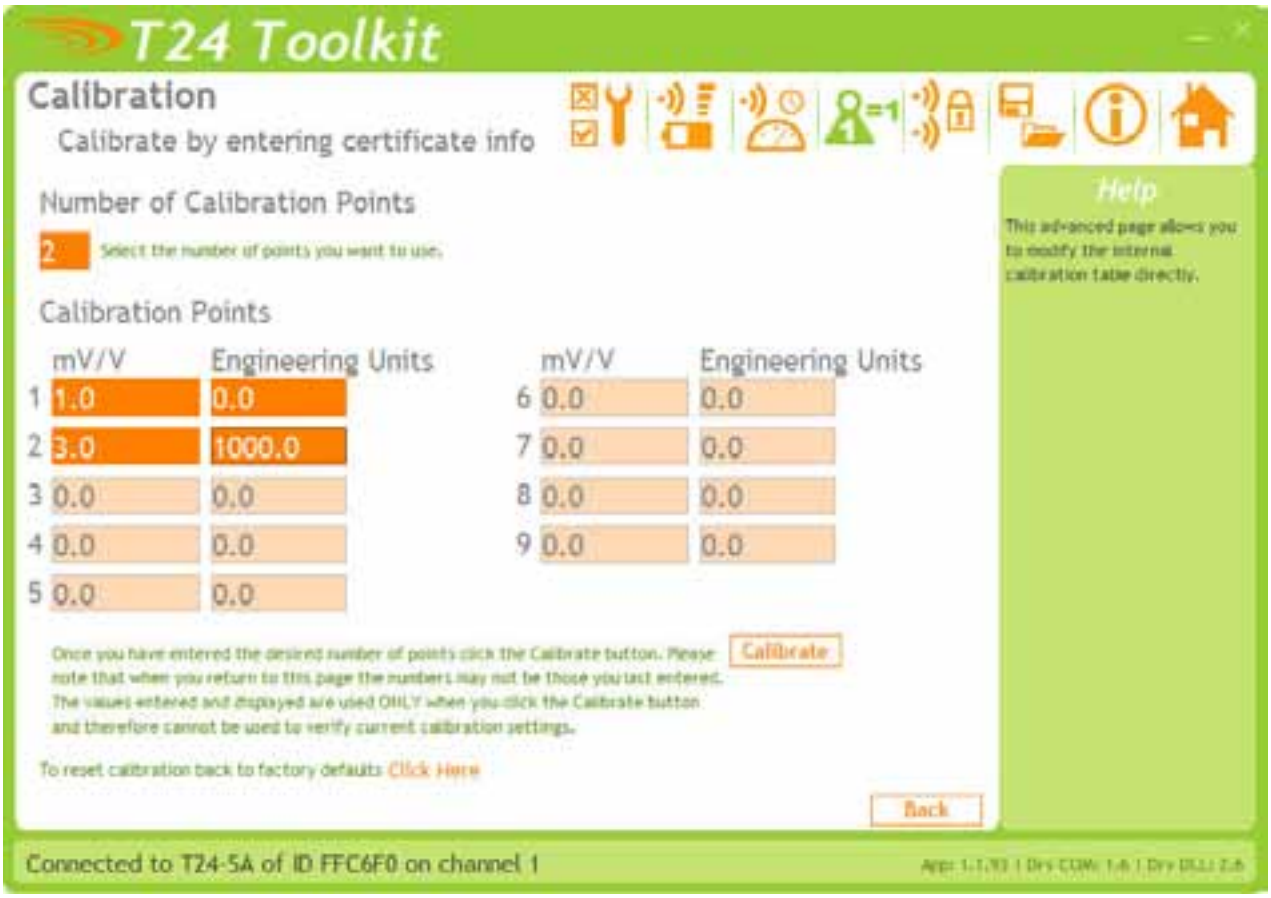
- Decide on how many points you will calibrate over.
- Decide what inputs (weights in the case of a T24-SA) will be applied (in ascending order) at each point.
- Enter the actual input (in the required units) that you want the module to read at each point.
- Now proceed to apply each input in turn (allowing a settle time) and click the **Acquire** button at that point. You can now apply the next input and click **Acquire** until all the points are completed.

The bottom of the page shows the **Input Value** and the **Calibrated Value**. Once the second point has been acquired this **Calibrated Value** should display the actual calibrated value.

Items you can change:

Number of Calibration Points	Enter the number of points you wish to calibrate over. In its simplest form you could select two for a linear calibration. For more complex calibrations which include linearization select three to nine points.
Point 1 - 9	For each point enter the engineering unit value that you want the acquisition module to report at the applied input. i.e. 1.67
Acquire 1 - 9	Click this button when the input has been applied and the reading has been allowed to settle. This will acquire the reading and allow you to move to the next points. You will be able to click the button again to re-acquire.
Start Again	Click here to restart the calibration.
System Zero	Once calibrated you may want to remove a fixed system value. In the case of a strain gauge input this may be the weight of a sling, shackle, load bed etc. Apply the required input and click here to set the system zero. The current input will be removed from subsequent readings so that the reading will be zero. To edit this value manually click the **Advanced** button. System Zero is stored in non-volatile memory in the acquisition module.
By Cert.	You can click the **By Cert** button to calibrate against a sensor calibration sheet. You just need to enter the input values and associated engineering unit required output value of at least 2 points. This will take you to a different screen.
Advanced	Clicking the advanced button will allow you to edit the gains and offsets for each available calibration point. This will take you to a different screen.

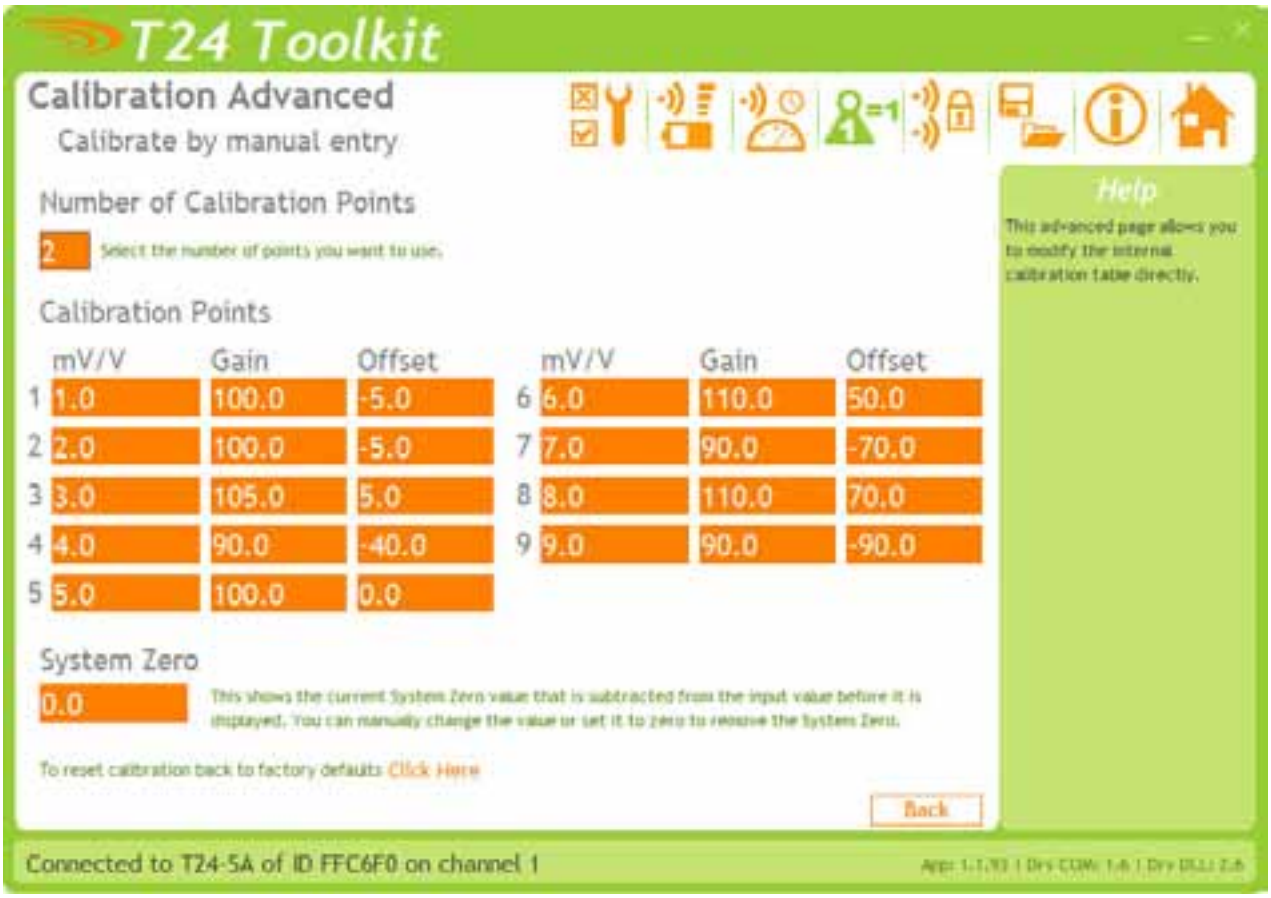
BWSHK Calibration By Certificate


T24 Toolkit
Calibration
Calibrate by entering certificate info
Number of Calibration Points
2
Select the number of points you want to use.
Calibration Points
mV/V
Engineering Units
1 1.0 0.0
2 3.0 1000.0
3 0.0 0.0
4 0.0 0.0
5 0.0 0.0
6 0.0 0.0
7 0.0 0.0
8 0.0 0.0
9 0.0 0.0
Once you have entered the desired number of points click the Calibrate button. Please note that when you return to this page the numbers may not be those you last entered. The values entered and displayed are used ONLY when you click the Calibrate button and therefore cannot be used to verify current calibration settings.
Calibrate
To reset calibration back to factory defaults Click Here
Back
Help
This advanced page allows you to modify the internal calibration table directly.
Connected to T24-5A of ID FFC6F0 on channel 1

In some circumstances it may not be possible to apply inputs in which case the calibration can be entered manually from the calibration table or certificate for a loadcell without ever having to connect the loadcell.

Items you can change:	
Number of Calibration Points	Enter the number of points you wish to calibrate over. In its simplest form you could select two for a linear calibration. For more complex calibrations which include linearization select three to nine points.
Input Points 1 – 9 (mV/V shown in this screenshot)	Enter the input point for which you will specify a required engineering output value
Engineering Units 1 - 9	Enter the required engineering unit output for the specified input value
Calibrate	Click this button to calculate and update the device calibration

BWSHK Calibration Advanced



In some circumstances it may not be possible to apply inputs in which case the calibration can be entered manually.
For example, if a strain gauge manufacturer provides a calibration table for a cell it may be possible to calculate gains and offsets and enter these values into the Advanced Calibration page without having to connect the strain gauge or apply weights.

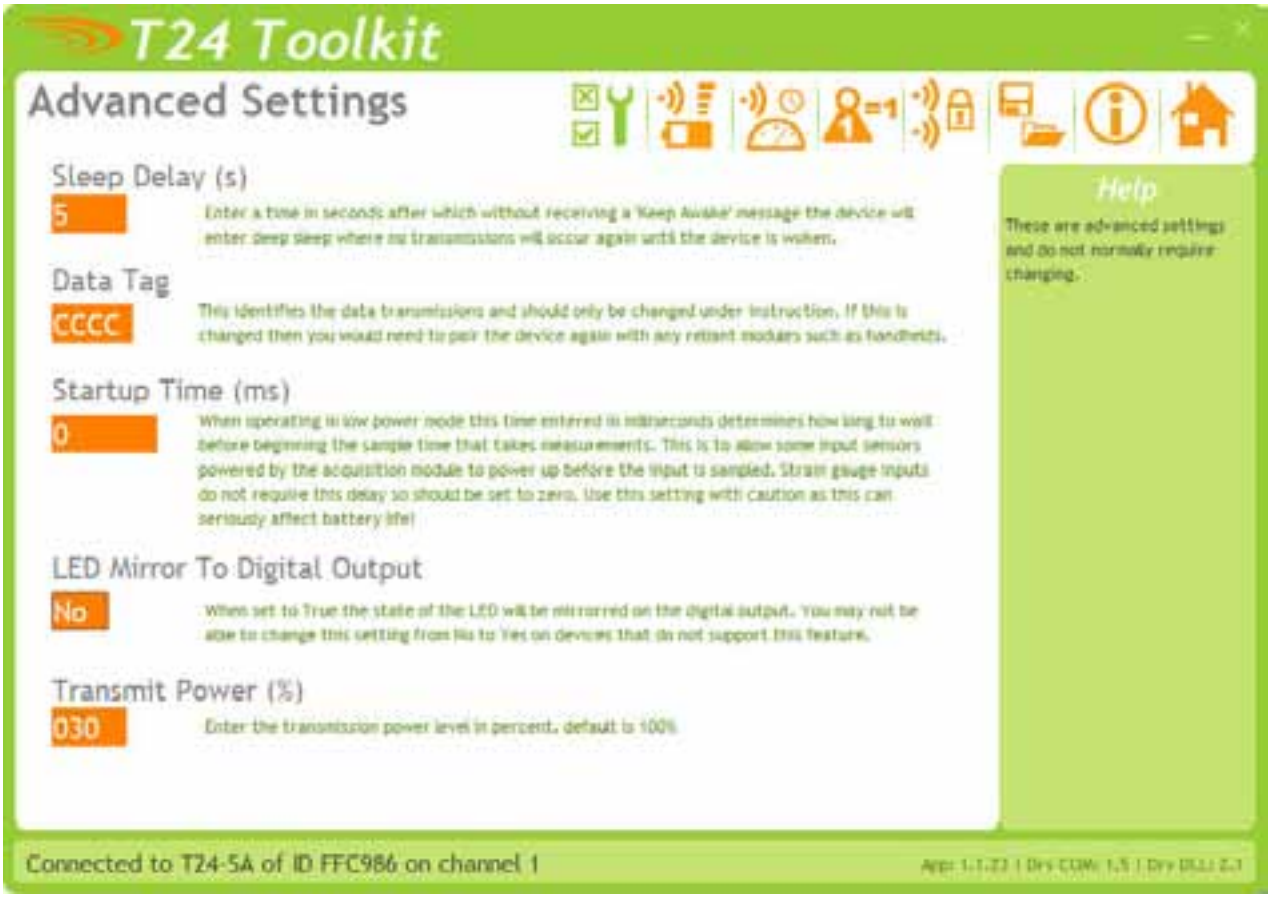
Items you can change:	
Number of Calibration Points	Enter the number of points you wish to calibrate over. In its simplest form you could select two for a linear calibration. For more complex calibrations which include linearization select three to nine points.
Input Points 1 – 9 (mV/V shown in this screenshot)	Enter the input point to which the associated interpolated gain and offset values will be applied. Note between points the gain and offset values are linearly interpolated. Inputs are extrapolated below point 1 and above point 9.
Gain 1 - 9	Enter the gain value for associated point
Offset 1 - 9	Enter the Offset value for associated point
System Zero	You can set the system zero value here or set it to zero to remove the system zero effect.

Description of Linearisation Calculations
The input value is looked up in a table of points which is dependent on what the user has selected, starting from the bottom of the table. When a point is found to which the input is less than then this point and the

previous point are used to extrapolate a gain and offset from. This leads to a resultant gain and offset which is applied to the mV/V values as follows.

```
Value = (input * Resultant Gain) – Resultant Offset.
```

BWSHK Advanced Settings


T24 Toolkit
Advanced Settings
Sleep Delay (s)
5
Enter a time in seconds after which without receiving a 'Keep Awake' message the device will enter deep sleep where no transmissions will occur again until the device is woken.
Data Tag
CCCC
This identifies the data transmissions and should only be changed under instruction. If this is changed then you would need to pair the device again with any reliant modules such as handhelds.
Startup Time (ms)
0
When operating in low power mode this time entered in milliseconds determines how long to wait before beginning the sample time that takes measurements. This is to allow some input sensors powered by the acquisition module to power up before the input is sampled. Strain gauge inputs do not require this delay so should be set to zero. Use this setting with caution as this can seriously affect battery life!
LED Mirror To Digital Output
No
When set to True the state of the LED will be mirrored on the digital output. You may not be able to change this setting from No to Yes on devices that do not support this feature.
Transmit Power (%)
030
Enter the transmission power level in percent, default is 100%
Help
These are advanced settings and do not normally require changing.
Connected to T24-5A of ID FFC986 on channel 1

You should not normally need to change these settings.

Items you can change:

Sleep Delay	Here you can enter a delay in seconds after which the acquisition module will return to deep sleep if no Keep Awake message is heard from the T24-HS handheld. The default is 60 seconds.
Data Tag	The data transmitted by the acquisition module is marked with a Data Tag which is a 2 byte hexadecimal code. By default this is set to the last 2 bytes of the device ID (or to put it another way, the last 4 characters of the device ID). If by some chance you had two acquisition module devices that would be working on the same channel and had the same last 4 characters in their ID (1 in 65,535 chances) you may want to change the data Tag of one of the devices and perform pairing again with the T24-HS handheld.
Startup Time	Some acquisition modules power a sensor from their excitation voltage. When coupled to a sensor with a slow startup time this setting is used to delay the measurement after wakeup from sleep between readings. This gives the sensor time to settle at the expense of battery life. For strain gauge inputs this settings should be zero.
LED Mirror to Digital Output	When set to Yes each time the LED is active the digital output is active. This can be useful if the module is to be encapsulated or enclosed and enables a second LED to be externally mounted. This is very useful when using a T24-HR roaming handheld as the acquisition module LED will activate while the handheld is in communications with the module.
Transmit power	Set the transmit power level from 0 – 100%. Default is 100%

Specifications

General Radio

	Min	Typical	Max	Units
License		License Exempt		
Modulation method		MS (QPSK)		
Radio type		Transceiver (2 way)		
Data rate		250		K bits/sec
Radio Frequency	2.4000		2.4835	GHz
Power		1		mw
Range RAD24i (Integrated antenna)			120 (400)	Metres (feet) *
Range RAD24e (External antenna)			200 (650)	Metres (feet) *
Channels (DSSS)		16		

* Maximum range achieved in open field site with T24-SA at a height of 3 metres above ground and T24-HS held at chest height pointing towards the T24-SA.

T24-HR

Electrical	Min	Typical	Max	Units
Power Supply voltage	2.4	3.0	3.6	V dc

Power Supply	Min	Typical	Max	Units
Active		35	40	mA
Low power mode		120	160	uA
Estimated Battery life using 2Ahr batteries:				
Standby mode (Powered off)		1.5		Years
Continuous operation		40		Hours

Environmental	Min	Typical	Max	Units
IP rating		IP65		
Operating temperature range	-10		+50	C
Storage temperature	-40		+85	C
Humidity	0		95	%RH

Physical	
Hand Held Dimensions	90 x 152 x 34mm

T24-SA

Specification with 1000R bridge, 2.5mV/V, at 3V supply at 25°C

Measurement	Min	Typical	Max	Units
Strain Gauge Excitation System		4 Wire		
Strain Gauge Excitation Voltage	4. 5	5	5.25	VDC
Strain Gauge Drive Capability	85	-	5000	Ohms
Maximum Gauge Sensitivity (FR)			3.2	+/-mV/V
Offset Temperature Stability		1	4	ppm/°C
Gain Temperature Stability		3	5	ppm/°C
Offset Stability with Time		20	80	ppm of FR (1)
Gain Stability with Time			30	ppm of FR (2)
Non Linearity before Linearization		5	25	ppm of FR
Internal Resolution		16,000,000/ 24		Resolution/Bits
Noise Free where Sample Time < 10mS		50,000 / 15.5		Resolution/Bits

Noise Free where Sample Time < 50mS		65,000 / 16		Resolution/Bits
Noise Free where Sample Time < 100mS		150,000 / 17.25		Resolution/Bits
Noise Free where Sample Time < 1000mS		250,000 / 18		Resolution/Bits
Noise Free where Sample Time > 1000mS		400,000 / 18.75		Resolution/Bits

1. From original offset at any time.
2. First year.

Electrical	Min	Typical	Max	Units
Power Supply voltage	2.1	3.0	3.6	V dc
Power Supply ripple			50	mV ac pk-pk

Power Supply current	Min	Typical	Max	Units
Normal Mode (1K Bridge)		60	65	mA
Standby / Low power mode		5	20	uA

Environmental	Min	Typical	Max	Units
Operating temperature range	-40		+85	˚C
Storage temperature	-40		+85	˚C
Humidity	0		95	%RH

Physical	
PCB Dimensions	17 x 37.5 x 6.5mm

Approvals

CE

CE

Complies with EMC directive. 2004/108/EC
The Radio Equipment and Telecommunications Terminal Equipment (R&TTE) Directive, 1999/5/EC,

European Community, Switzerland, Norway, Iceland, and Liechtenstein

English:	This equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Deutsch:	Dieses Gerät entspricht den grundlegenden Anforderungen und den weiteren entsprecheneden Vorgaben der Richtlinie 1999/5/EU.
Dansk:	Dette udstyr er i overensstemmelse med de væsentlige krav og andre relevante bestemmelser i Directiv 1999/5/EF.
Español:	Este equipo cumple con los requisitos esenciales asi como con otras disposiciones de la Directive 1999/5/EC.
Français:	Cet appareil est conforme aux exigencies essentialles et aux autres dispositions pertinantes de la Directive 1999/5/EC.
Íslenska:	Þessi búnaður samrýmist lögboðnum kröfum og öðrum ákvæðum tilskipunar 1999/5/ESB.
Italiano:	Questo apparato é conforme ai requisiti essenziali ed agli altri principi sanciti dalla Direttiva 1999/5/EC.
Nederlands:	Deze apparatuur voldoet aan de belangrijkste eisen en andere voorzieningen van richtlijn 1999/5/EC.
Norsk:	Dette utstyret er i samsvar med de grunnleggende krav og andre relevante bestemmelser i EU-directiv 1999/5/EC.
Português:	Este equipamento satisfaz os requisitos essenciais e outras provisões da Directiva 1999/5/EC.
Suomalainen:	Tämä laite täyttää direktiivin 1999/5/EY oleelliset vaatimukset ja on siinä asetettujen muidenkin ehtojen mukainen.
Svenska:	Denna utrustning är i överensstämmelse med de väsentliga kraven och andra relevanta bestämmelser i Direktiv 1999/5/EC.

This equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

FCC

FC

Family: RAD24
Models: i and e for internal and external antenna variants. For antenna T24-ANTA and T24-ANTB
FCC ID:VHARAD24
This device complies with Part 15c of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CAUTION: If the device is changed or modified without permission from Mantracourt Electronics Ltd, the user may void his or her authority to operate the equipment.

Industry Canada

Models: i and e for internal and external antenna variants. For antenna T24-ANTA and T24-ANTB
IC:7224A-RAD24
This apparatus complies with RSS-210 - Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment RSS.

OEM / Reseller Marking and Documentation Requirements

FCC

The Original Equipment Manufacturer (OEM) must ensure that FCC labelling requirements are met. This includes a clearly visible label on the outside of the final product enclosure that displays the contents as shown:

> Contains FCC ID:VHARAD24
>
> This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
>
> (1) this device may not cause harmful interference and
>
> (2) this device must accept any interference received, including interference that may cause undesired operation.

The acquisition modules have been tested with T24-ANTA and T24-ANTB. When integrated in OEM products, fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Antennas other than T24-ANTA and T24-ANTB must be tested to comply with FCC Section 15.203 (unique antenna connectors) and Section 15.247 (emissions).

Acquisition modules have been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Changes or modifications not expressly approved by Mantracourt could void the user's authority to operate the equipment.

In order to fulfil the certification requirements, the OEM must comply with FCC regulations:
1. The system integrator must ensure that the text on the external label provided with this device is placed on the outside of the final product.
2. The acquisition modules with external antennas may be used only with Approved Antennas that have been tested by mantracourt.

IC

Labelling requirements for Industry Canada are similar to those of the FCC. A clearly visible label on the outside of the final product enclosure must display the following text:

> Contains Model RAD24 Radio (2.4 GHz), IC:7224A-RAD24

Integrator is responsible for its product to comply with RSS-210 - Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment RSS.

CE

The T24 series has been certified for several European countries.
If the acquisition module is incorporated into a product, the manufacturer must ensure compliance of the final product to the European harmonized EMC and low-voltage/safety standards. A Declaration of Conformity must be issued for each of these standards and kept on file as described in Annex II of the R&TTE Directive. Furthermore, the manufacturer must maintain a copy of the T24 device user manual documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation requirements as specified in the user manual. If any of these specifications are exceeded in the final product, a submission must be made to a notified body for compliance testing to all required standards.
OEM Labelling Requirements
The 'CE' marking must be affixed to a visible location on the OEM product.

The CE mark shall consist of the initials “CE” taking the following form:

- If the CE marking is reduced or enlarged, the proportions given in the above graduated drawing must be respected.
- The CE marking must have a height of at least 5mm except where this is not possible on account of the nature of the apparatus.
- The CE marking must be affixed visibly, legibly, and indelibly.

Declaration Of Conformity

We, **Mantracourt Electronics Limited**
The Drive
Farringdon
Exeter
Devon EX5 2JB
declare under our sole responsibility that our products in the **T24 Radio Telemetry Product Range** to which this declaration relates are in conformity with the appropriate standard EN 300 328 following the provisions of the Radio and Telecommunications Terminal Equipment Directive **1999/5/EC**, **FCC CFR Title 47** part 15c BS EN 61000-4-2 and BS EN 61000-4-3 following the provisions of the EMC Directive **2004/108/EC** and Low Voltage Directive **2006/95/EC**.

December 2007

Brett James
Development Manager
Mantracourt Electronics Limited.

FCC ID:VHARAD24

CE

Worldwide Regional Approvals

Region	Product Conforms To
Europe	CE
USA	FCC
Canada	IC
Australia	To Be Determined
China	To Be Determined
Japan	To Be Determined

Important Note

Mantracourt does not list the entire set of standards that must be met for each country. Mantracourt customers assume full responsibility for learning and meeting the required guidelines for each country in their distribution market. For more information relating to European compliance of an OEM product incorporating the T24 range of modules, contact Mantracourt, or refer to the following web site: **www.ero.dk**

Warranty

All Telemetry products from Mantracourt Electronics Ltd., ('Mantracourt') are warranted against defective material and workmanship for a period of (1) one year from the date of dispatch.
If the 'Mantracourt' product you purchase appears to have a defect in material or workmanship or fails during normal use within the period, please contact your Distributor, who will assist you in resolving the problem. If it is necessary to return the product to 'Mantracourt' please include a note stating name, company, address, phone number and a detailed description of the problem. Also, please indicate if it is a warranty repair.
The sender is responsible for shipping charges, freight insurance and proper packaging to prevent breakage in transit.
'Mantracourt' warranty does not apply to defects resulting from action of the buyer such as mishandling, improper interfacing, operation outside of design limits, improper repair or unauthorised modification.
No other warranties are expressed or implied. 'Mantracourt' specifically disclaims any implied warranties of merchantability or fitness for a specific purpose. The remedies outlined above are the buyer's only remedies. 'Mantracourt' will not be liable for direct, indirect, special, incidental or consequential damages whether based on the contract, tort or other legal theory.
Any corrective maintenance required after the warranty period should be performed by 'Mantracourt' approved personnel only.

CE

In the interests of continued product development, Mantracourt Electronics Limited reserves the right to alter product specifications without prior notice.

DESIGNED & MANUFACTURED IN THE UK

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